



EP046

Hydra/Mechanical Drilling Jar

Operations Manual

Covers all sizes

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INTRODUCTION

EP046 – Jar Operations Manual

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Built to perform

The Cougar Hydraulic/Mechanical drilling jar is one of the toughest and more durable jars in the oil industry worldwide. Designed and operated in and for a wide range of applications this jar is ideal for directional, horizontal and deep hole applications, both on and offshore. The Cougar drilling jar is a proven performer worldwide. Reliable state of the art design assures our customers of proven performance when needed.

Simple two-way operation

The two-way action of the jar gives the operator the ability to work the jar both upwards and downwards. The mechanical latch assures the operator that the jar will not accidentally fire while tripping or making connections. The hydraulic operation upwards allows the customer to utilize pipe stretch to assist in the jarring performance and use the drill collar mass to assist in the jar impact. The jar can be pulled harder to give greater impact or pulled lighter to give a lesser impact. The downward jarring is achieved mechanically by overcoming the downward lock setting, thus allowing the operator to fire the jar downward using the string weight above the jar in a hammering manner.

BENEFITS

- Jar placement service offered for every run.
- Placement optimized to maximize jarring forces.
- Placement analysis performed at multiple, potential stuck points.
- Contact your sales representative to initiate a jar placement.

FEATURES

- Cougars Hydraulic/Mechanical Drilling Jar can be operated in:
 - ❖ DJ10/DJ10A hydra-mechanical up and down
 - ❖ DJ6 hydra-mechanical up and mechanical down
- Not affected by torque.
- Mechanical latch feature locks tool internally eliminating the need for an external safety clamp or collar.
- Mechanical latch feature eliminates un-intended firing of tool so that the Jar will not fire unexpectedly while tripping or making connections.
- Standard operating temperatures up to 250°F (121°C). Special seals are available for operating temperatures up to 400°F (205°C).

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PRE-JOB PLANNING / DRILLING JAR PLACEMENT

Cougar offers services of Jar placement and software to assist with proper placements. Correct jar placement not only ensures long life and reliability of the tools, it also ensures the jar can be fired as intended with maximized jarring forces.

It is imperative that a placement analysis is performed for every Drilling Jar deployment. BHA's that have been previously analyzed only require further analysis if drilling parameters change.

It is the responsibility of the sales team to coordinate with the customer and submit a placement request to eng-support@cougards.com.

A completed **ED074** form must be attached to the placement request. Placements without a completed **ED074** or placements received directly from the customer will not be analyzed.

(For internal use follow EP059 & EP059A for pre-placement request procedures)

If the customer chooses not to use Cougars Jar Placement services:

- As a general rule of thumb, for optimal jarring effects, the jar should be placed between the bottom third and the mid-point of the drill collars section. For example, if 18 drill collars are used, place 6 to 9 drill collars below the jar. The type of formations and presence of key seats or doglegs may dictate the jar be placed higher. A more detailed analysis of the drilling assembly may suggest alternate placements.
- Running the jar in compression is preferred. Running the tool at least two collars below the neutral point should ensure that the tool remains in compression and to minimize the damage due to cyclic fatigue.
- At least one collar should be placed between the top stabilizer and the jar to reduce bending. When the hole diameter is greater than twice the tool diameter, two collars should be run on the top stabilizer. This is true for pendulum or packed assemblies.
- When running the jar in tension the jar should be placed such that the weight below the jar does not exceed the upward latch setting. This will ensure the jar remains in the latched position to reduce bending damage and accidental firing.
- The jar must **not** be placed in the drill string between a transition in collar sizes, i.e. between 10" and 9" collars.
- Drill collars will assist the performance of the jars enhancing their performance and increasing impact.
- The harder the jar is pulled, the greater the impact, the softer they are pulled the softer impact. Maximum push/pull force is provided above.
- It is recommended to run the jars in compression in lower section of the drill collars if possible and running the jars at the neutral point should always be avoided. See Placement section of this manual for more detailed information and Safe Practices for cautions.

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OPERATING PROCEDURES

The Jar placement output summary will specify the hook loads necessary to Jar Up and Jar Down. The text below provides a simplified summary of the jarring calculation.

JARRING UP

To jar upwards; Calculate the Pull Force required to unlatching and begin hydraulic metering of the jar using the following formula:

$$\text{Formula: Pulling force} = \text{lock setting} + \text{buoyed drill string weight above the jar} + \text{hole drag} - \text{pump open force}$$

(Pump open force = washpipe area x pressure drop across bit)

- Load settings and metering times are stenciled on the side of the tool.
- Pull with a force to exceed the latch settings and drilling parameters mentioned above.
- After the latch is released pull up to maximum pull for firing.
 - ❖ **Do not exceed the maximum pre-firing pull value on the specification table for specific tool size and type.**
- Hold this Pull Force until the jar fires.
- Lower the jar to reset the jar.
- Repeat previous steps if necessary.

The jar will unlatch and begin the metering sequence once the pull force is exceeded. At this time the jar can be pulled harder or lighter to increase or decrease impact. Increased pull forces will also cause the hydraulic oil inside the jar to meter faster and will reduce the delay time for the jar to reach impact.

JARRING DOWN

To jar downwards; Calculate the latch settings to be exceeded with downward force or weight to unlatch the jar and begin metering.

$$\text{Formula: Pushing Force} = \text{lock setting} + \text{pump open force} + \text{hole drag}$$

- Load settings and metering times are stenciled on the side of the tool.
- Apply calculated weight or push force to exceed the latch load settings and drilling parameters mentioned above.
- After the latch mechanism is released the jar will begin to meter hydraulically. The weight indicator will begin to decrease as the jar is metering and decrease rapidly just before the jar fires. At that point, the latch will release suddenly allowing the jar to travel freely until the jar closes, creating a downward blow.
- Raise the string to reset the jar plus any additional required pull.
 - ❖ **Do not exceed the maximum push/pull after firing value on the specification table for specific tool size and type.**

Raising the drill string until free movement stops will indicate that the Mechanical latch is reset. The jar is then ready to be fired once again in either direction.
- Repeat previous steps if necessary.

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OPERATING LIMITS

TOOL	OD (in)	ID (in)	LENGTH (ft)	FREE STROKE (in)	NOMINAL LATCH SETTINGS (lb)	PUMP OPEN AREA (in ²)	MAXIMUM SAFE OPERATING TORQUE (lbf-ft)	MAXIMUM FAILURE TORQUE (lbf-ft)	MAXIMUM PULL BEFORE FIRING (lb)	MAXIMUM PULL AFTER FIRING (lb)
DJ6-350	3.50	1.150	18.0	5↓ 6↑	36,000	4.9	3,000	5,000	54,000	119,000
DJ6/10-418	4.125	2.000	18.0/19.0	6↓ 6↑	45,000	7.8	8,000	14,000	115,000	190,000
DJ6/10-500	4.875	2.250	17.0/19.0	6↓ 6↑	40,000	11.0	11,500	17,000	84,000	380,000
DJ10A-500	4.875	2.280	17.0/19.0	6↓ 6↑	40,000	11.0	11,500	17,000	84,000	380,000
DJ6/10-650	6.550	2.500	17.5/18.5	6↓ 5↑	110,000	16.8	25,000	40,000	156,000	685,000
DJ8-650	6.550	2.280	16.0	6↓ 6↑	110,000	15.9	25,000	35,000	170,000	625,000
DJ6-675	6.880	2.625	17.5	6↓ 6↑	110,000	18.7	26,000	40,000	179,000	625,000
DJ10-675	6.880	2.750	20.0	6↓ 6↑	110,000	18.7	26,000	45,000	165,000	600,000
DJ10-700	7.030	2.750	20.0	6↓ 6↑	110,000	18.7	26,000	45,000	165,000	600,000
DJ6/10-800	8.150	2.813	19.0/19.5	9↓ 6↑	110,000	28.2	50,000	68,000	291,000	1,150,000
DJ10-825	8.250	2.813	19.5	9↓ 6↑	110,000	28.2	50,000	68,000	291,000	1,150,000
DJ6-900	9.150	2.813	19.5	9↓ 6↑	120,000	33.2	75,000	121,000	361,000	1,500,000
DJ6/10-950	9.550	2.813	19.5/20.0	9↓ 6↑	120,000	33.2	90,000	141,000	361,000	1,500,000
DJ6/10-1000	10.000	3.000	19.5/20.0	9↓ 6↑	120,000	33.2	120,000	170,000	400,000	1,500,000

* Dogleg limitations and their effects on component fatigue life are available upon request.

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OPERATING HOURS

In order to ensure an optimal performance of a Cougar Drilling Solutions drilling jar, it is important to stay within the recommended operating hours range. The number of operating hours depends upon many drilling factors such as: hole deviation, bottom hole assembly, type of formation, doglegs, placement of jar, drillstring vibrations, hole temperature, and drillstring rotational speed. Since these factors can vary greatly from one hole to another, and even within the same hole, it is difficult if not impractical to calculate an *accurate* number of operating hours. A more practical approach is to determine an *operating hours range* based on evaluating the overall condition of the hole.

The following table contains a guideline for determining the range of operating hours:

	Rotary Speed (RPM)		
Hole Condition	80 or less	100	120 or more
	Operating Hours		
Easy	550 h	525 h	500 h
Normal	450 h	425 h	400 h
Tough	350 h	325 h	300 h

These figures are based on performance history and have proven to be effective. It is up to the drilling foreman, however, to evaluate the overall hole condition.

SAFE USE AND HANDLING PRACTICES

- Galling on the faces of tool joint connections can be avoided by adhering to API standards
 - ❖ **Clean and lubricate the threads and faces and only apply recommended make-up torque.**
- Hydraulic metering jets are damaged and hydraulic washpipes stretched when exceeding the recommended pre-firing pull value that is listed in in the Specification section of this manual.
 - ❖ **Adhere to operational specifications to maintain proper performance and integrity of Cougar's tools.**
- Tong marks and other damage have been observed on sealing surfaces. Damage to the chrome/carbide can lead to catastrophic consequences.
 - ❖ **Chrome/carbide surfaces should not be clamped with any device.**
- Fractures of the Drilling Jars have been attributed to rotating bending fatigue. In particular cases the male splines have developed cracks from being run in the fully open position.
 - ❖ **Follow jar placement guidelines to avoid fatigue fractures by not running jars fully open or extended in tension.**

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RECOMMENDED SIZES

HOLE SIZE	RECOMMENDED DRILLING JAR SIZE OR SIZES
34"	10" 9 1/2"
28"	10" 9 1/2"
22"	10" 9 1/2"
17"	9 1/2" 9"
16"	9 1/2" 9"
12 1/4"	9" 8"
12"	9" 8"
8 1/2"	7" 6 3/4" 6 1/2"
8 3/8"	6 3/4" 6 1/2"
6 1/8"	5"
6"	5"
5 5/8"	5" 4 1/8"

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TOOL FLAGS

It is the responsibility of the sales team to flag tools that may need additional investigation upon teardown. For example, customer feedback relating to: excessive torque or dogleg, severe stick-slip, jarring, back reaming etc. etc.

FAILURES

In the event of a failure, it is the responsibility of the sales team to communicate the failure to inside sales and Engineering by flagging the tool in CGMS. Inside sales will be responsible for entering customer comments into CGMS. The tool will remain quarantined until investigated by Engineering. Engineering will be responsible for uploading the failure report into CGMS and closing out the incident. The Jar will remain quarantined until the incident has been closed or otherwise instructed by Engineering.

(For internal use follow EP060 & EP060A & EP060B for failure procedures)

REFERENCE DOCUMENTATION

ED001 – Typical Lock Loads

ED002J – Jar Max and Min Measurements at Service.

ED003J – Jar Make-up Torques.

ED005 – Drift Sizes.

ED008 – Spring Configurations.

ED028 – Approximate Shipping Weights.

EP012 – DJ6 Service Manual.

EP039 – DJ10 Service Manual.

EP051 – Magnetic Particle Inspection.

EP055 – H2S Procedure.

EB.054.11.12.04 – Refacing of Rotary Shoulders